



## **SafetyNet. Human factors safety training on the Internet**

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# **SafetyNet**

Human Factors Safety Training on the Internet

**Gunnar Hauland og Mauro Pedrali**

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**ESPRIT PROJECT 23917**

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Deliverable D111, User Requirements Report  
October the 1<sup>st</sup>, 1997

AVITRACO	Denmark	Project Co-ordinator
DMI	Denmark	Main Partner
SASFA	Sweden	Associated Partner
CAAA	Denmark	Associated Partner
DEDALE	France	Main Partner
RISØ	Denmark	Main Partner
JRC	Italy	Associated Partner

**Risø National Laboratory, Roskilde**  
**January 2002**

**Abstract** This report describes user requirements to an Internet based distance learning system of human factors training, i.e. the SafetyNet prototype, within the aviation (pilots and air traffic control), maritime and medical domains. User requirements to training have been elicited through 19 semi-structured interviews (60 minutes each). The informants (interviewees) were mainly end users, i.e. instructors and trainees. They expressed general agreement on “major course contents” and some doubts concerning “methods of knowledge delivery” and the “learning environment”.

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# 1 Introduction

It is widely recognised that the majority of incidents and accidents within aviation, maritime operations and similar domains are due in part or entirely to “human errors”. Starting in the late seventies, crews within these domains have received human factors training in the form of Crew Resource Management (CRM) training. Basic courses teaching human factors theory only were also used. (This report will not attempt to describe CRM practices. See e.g. Helmreich, 1996, FAA, 1995, Hayward 1995, Pariès and Amalberti, 1995, and Wiener, Kanki and Helmreich, 1993.)

To make crews within these domains available for initial or recurrent CRM training at the same time on the same location, they have to be taken out of production for a number of days. This includes travelling to and from the venue of training. Distance learning of CRM may contribute to the solution of this practical problem. The challenge is to develop a distance learning program that can facilitate learning of parts of CRM at least as good as traditional teaching (for theory; see e.g. Moore and Kearsley, 1996, and Rekkedal, 1994, summarised in D112, Sanderson, 1997). The Aim of SafetyNet is to demonstrate a scaleable internet based subscription service as a supplement to existing CRM training. It is important to stress that the SafetyNet objectives are not to replace traditional face-to-face training, but to complement conventional training. The requirements of trainees and instructors will be used as inputs to the development of the SafetyNet prototype application (requirements will be analysed in D121 and D131).

This report adapts the framework given in the “Distance Learning and Best Practice Report D112” (Sanderson, 1997, chapters 3-5) to the SafetyNet requirements in terms of the issues raised with our informants, i.e. the structure of the questions posed to them. These specific user requirements are based on conversations with informants from the aviation, maritime and medical domains: their description of existing CRM training at their institution and their thoughts about possible extensions of CRM training to a distance learning format.

## 2 Crew Resource Management (CRM)

### 2.1 CRM Goals

The following sums up the main goals of CRM as stated by the informants.

The informants were either instructors (not necessarily CRM instructor) or trainees within the domain. Regulators were also interviewed. Nearly all informants thought that their mother-organisation had CRM as a high priority. All

informants agreed that CRM training is relevant to their work.

- CRM training goals were defined in terms of “increasing safety to avoid incidents and accidents”. It was emphasised that the training goals must be related to domain specific operational situations.
- Crew collaboration and improved crew attitudes towards safety issues and cost efficiency issues were specifically mentioned.
- A better and standardised crew education, aimed at the co-operation and at the management of cockpit resources.
- CRM training should involve all people working in an airline. A main goal of CRM is setting up a common “corporate safety culture” within the company.
- Crew members are different and (critical) situations are different. CRM training should therefore be differentiated.
- It was suggested that the “team/crew” concepts should be expanded to include co-operation between teams/crews. Thus, a team can be defined both within and between domains, e.g. pilots/aircraft crews and ATC personnel may be considered to be in “teams” together.

## 2.2 CRM Training Contents

Systematic CRM training is relatively new to all the interviewed stakeholders, except SAS that started with the first generation CRM courses in 1987. All CRM courses are reported to be tailored to the domain. It was claimed that a general CRM course, i.e. not domain specific, is less useful and should not be conducted without configuration to the specific domain and the specific company.

Informants described a distinction in CRM training: the introductory courses and the refresher courses. Usually an introductory course has a duration of approximately 2-3 days, it involves 1-2 instructors and approximately 6-8 trainees (or possibly up to 12-14 people). Introductory courses are often combined with full scale simulator training, but CRM is usually not a separate part of such simulator training. Informants expressed a wish for more specific CRM simulator training. This type of course is an “once in a lifetime” event. In addition comes the refresher courses. These may be combined with technical training, like in Periodic Flight Training (PFT), and include a check of CRM performance.

The following is a short summary of CRM training within DMI, SAS, MAERSK AIR, CAAA (ATC school in Denmark), ATC in Denmark; Billund and Roskilde, ATC in Sweden and the Danish National Hospital in Copenhagen (Anaesthesia):

### **DMI**

Maritime CRM courses are offered on a commercial basis. Courses are tailor-made to the customer. A distinction is made between simulator training and more “theoretical CRM” training. CRM training at DMI also includes practical communication tasks. CRM courses can be held at different locations around

the world. These courses are usually “once in a lifetime events” for the trainees. The CRM courses are relatively new (DMI began CRM training three years ago) and approximately 24 courses are delivered every year. DMI also offers simulator training on a regular basis to, among others, navigation schools.

### **SAS**

“Cockpit Resource Management” (CRM) was implemented in training about 10 years ago. Not all pilots in SAS participated in these courses. CRM courses restarted two years ago. The CRM term has now developed into “Crew Resource Management”, i.e. including all personnel in the air plane. All new trainees go through 2 days of human factors training and 3 days of “CRM” Computer Based Training (CBT). Case studies of real accidents are used in addition to HF and CBT. These introductory courses are “once in a lifetime” events. Refresher courses are separated into 1) Periodic Ground Training (PGT) and 2) Periodic Flight Training (PFT). PFT is often referred to as LOFT simulations. PFT is also a check of CRM in that one must be able to do CRM to have an acceptable PFT performance. All crews must have PFT every 6<sup>th</sup> month.

### **MAERSK AIR**

Cockpit Resource management within Maersk Air started in 1991, in the Maersk training centre. It was held by a military psychologist in the form of ordinary class-room teaching, including lectures, group work, case studies and discussions. The course starts with an overview of CRM, (i.e. presenting basic concepts like “man-machine interaction”). Then it is focused on specific issues like: develop communication styles (e.g. “using questions” to solve problems), develop leadership and focus on personality issues, develop decision making skills, develop a team concept and develop stress management techniques. This initial CRM course is a “once in a lifetime event” (two days). There are still people who have not been through this course. There is no recurrent training at the moment, but instructors are supposed to comment on videos of crew behaviour during PFT. Earlier recurrent training, i.e. PFT, focused on the pilot’s ability to manoeuvre the plane correctly. Now, PFT’s are focusing on LOFT co-operation and decision making. In addition, a flight safety officer is gathering relevant information about incidents and accidents. There is also good co-operation with SAS on exchanging cases. Reports about incidents are not anonymous, but this is claimed not to be a problem (i.e. to discuss colleagues). However, the cases need restructuring to a more easily accessible format, i.e. feasible for educational purposes. Such a database does not exist today. The informant also said that it is a good idea to let pilots and ATC train together, i.e. using the same case for discussions.

### **AIR TRAFFIC CONTROL (ATC)**

#### ***CAAA (AIR TRAFFIC CONTROL SCHOOL IN DENMARK)***

The CAA Academy in Copenhagen is responsible for the education of new ATC personnel in Denmark and re-training and annual check of permanent staff. Team Resource Management” (TRM) is the practical ATC training in a simulator. TRM does not include human factors. (The terms TRM and CRM usually include human factors.) All trainees (starting 1992) go through four training modules. Modules 1-3 are theoretical human factors knowledge (12 lectures) and module 4 is practical TRM training (8 lectures). A debrief is held six months later. Older ATC-operators, i.e. educated before 1992, participate in the post-qualification course for all ATC personnel in Denmark (starting 1993) conducted every year. This course consists of approximately one day of theo-

retical human factors lectures and four days of practical/technical TRM training. All ATC personnel are also tested each year in relevant law regulations and technical issues.

#### *ATC IN DENMARK, OUTSIDE COPENHAGEN: BILLUND AND ROSKILDE*

There is no systematic CRM/TRM/HF training (i.e. human factors theory and practice) at ATC Billund, the second largest airport in Denmark. The only training possibility is CBT on ATC theory. A strong interest in CRM training co-operation with pilots, and with the ATC school in Copenhagen (CAAA), is expressed. There is also no CRM/TRM/HF courses within ATC Roskilde today, except for PFC evaluations. However, there will be developed a course together with Eurocontrol, possibly later this year. ATC Roskilde is organised as a part of ATC Copenhagen, with relatively frequent contact between ATC Roskilde and the CAAA in Copenhagen/Kastrup airport. However, it seems that TRM training co-operation with the CAAA is limited.

#### *ATC IN SWEDEN*

There is no recurrent TRM training in Sweden at the moment (i.e. training including HF elements), except PFC's every second year (one day). The plan is to start a TRM course next year in co-operation with Eurocontrol. The main "HF training" is not organised, but taking place during coffee breaks, i.e. when people talk about various work-related problems they have experienced. The initial ATC education in Sweden (2 years) integrates civilian and military ATC and includes elements of HF training: physiology, medicine and psychology (referred to as "pilot and air traffic controller interaction"; 4 lectures out of 28 lectures in general ATC/terminal control knowledge, and "aviation medicine and human performance"; 6 lectures out of 28 lectures total). The HF training goal is to "have knowledge of human limitations, reactions and psychological factors influencing the co-operation between pilots and ATC". The Swedish ATC also produces continuous reports of incidents. Every time something "critical" happens, a report must be written. Approximately 1000 incidents are reported every year. These reports are used in education and trainees also learn how to write such reports during their initial training. Although there are many national cases (incidents) registered, there is a lack of cases concerning international incidents and accidents. Cases used today are usually very old and well known accidents (e.g. the Tenerife'77 accident).

#### **THE DANISH NATIONAL HOSPITAL (ANAESTHESIA)**

There are three generations of CRM courses for anaesthesia personnel in Denmark. The 1<sup>st</sup> generation course started in 1992 and is aimed at all anaesthesia personnel (doctors and nurses). This is a one-day course held at various hospitals, with at least 7-8 instructors, partly commercialised and not mandatory. The distribution of theory and practice is approximately 50/50. The theory part is an introduction to CRM, containing three main issues: 1) management, 2) co-operation and 3) communication. Instructors try to avoid human factors terminology. A distinction is made between critical situations that are simple (i.e. easily recognised/known the procedures) and those that are complex diagnostic situations that require much information gathering. CRM will be different depending on the type of situation. One will also try to take individual personality characteristics into consideration. In the practical part, personnel is invited to train CRM using the anaesthesia simulator SOPHUS. Scenarios are focused on problems related to management and co-operation in the medical crew. The scenarios are based on real operations. Scenarios are video recorded and analysed in a debrief session, but participants are first briefed on how to analyse



behaviour from the video. Approximately 1/3 of the anaesthesia personnel in Denmark have been through SOPHUS simulator courses. The 2<sup>nd</sup> generation course is aimed at anaesthesia students only: in Denmark, as in some other countries, there is a lack of uniform procedures before and during operations. This is a major problem. This is therefore the main issue in addition to 1-3. The 3<sup>rd</sup> generation course is aimed at nurses only and focuses on communication problems. The 2<sup>nd</sup> and 3<sup>rd</sup> generation courses are new (1996) and they will both be mandatory 3-day courses. The future plan is to develop additional post qualification training for all personnel. CRM courses are designed by the SOPHUS group (15 CRM anaesthesia instructors) in continuous contact with instructors from other countries (e.g. USA) to exchange experience and scenarios.

**Informants pointed out the following major theoretical CRM training issues:**

- Human physical and mental limitations. Basic psychological concepts should be a part of the initial training, i.e. building a framework
- The practical relevance of these limitations to the specific domain. Too much theoretical human factors terminology and abbreviations should be avoided, especially during recurrent practical training.
- Problems related to crew co-operation and communication, specifically mixtures of languages.
- Problems related to individual differences in “culture”, specifically management style (see “Power-Distance”; Hofstede, 1984), and trust of other crews, i.e. pilots trust of Air Traffic Control (ATC). There is disagreement concerning to what extent these are problems. It is also emphasised that management styles (if possible) should vary with the situation.
- Focus on personality traits and personal limitations, but avoiding focus on individual blame. Individual crew members must know their own limitations and be able to take the perspectives of other crew members and people they communicate with. Selection of personnel is important, but even if “personality” is a part of the selection criteria, these issues should be included in CRM training as early as possible. It is also suggested that the individual crew member is followed over longer periods of time.
- The focus on issues of individual blame or “culpa” in civilian ATC is a serious problem. There is a need to develop a more error tolerant ATC environment in order to learn from incidents. Military ATC is claimed to be more tolerant towards individual “culpa” in order to maintain an effective airforce, i.e. team work.
- Establishing (emergency) procedures for anaesthesia personnel.

**A distance learning CRM course (within aviation) may include:**

The regulator informants strongly disagreed with the idea of a “distance” CRM course, but the “CRM” term was here used in the meaning of “practical training” only. Thus, these regulator informants claimed that distance training (through the Internet) should be used only to provide HF theoretical knowledge

(instructional).

- Factual “CRM knowledge” (theory) that can be repeated e.g. before PFT. Issues such as: communication, workload, assertiveness, automation, glass cockpit and fatigue, management styles, decision making, the problem of individual culpa.
- Easy access and fast update of a case data base, i.e. incidents and accidents, relevant to all crews.
- Discussion groups of such cases within the domain. Cases could be examples of real incidents and accidents caused by a lack of crew collaboration, i.e. lack of CRM. It is also valuable to have the conclusions from authorities investigating the incident/accident.
- Discussion groups of cases between domains: e.g. pilots and ATC could discuss the same case.

## 3 Methods of Knowledge Delivery

### 3.1 Types of Interaction

- It is emphasised by all informants that group discussions of real incidents/accidents are important when learning CRM, in addition to practical full scale simulator training and ordinary “face to face” training in groups. Different groups in a group discussion should also debrief each other. Emphasise should be put on disagreements and discussions between groups.
- There is a lack of authentic cases written in a format suitable for teaching and discussion, especially within ATC. The interest in and need for a continuously updated data base with authentic incidents and accidents is emphasised. One should possibly also include more “positive cases”, i.e. motivation may come from the successful handling of a critical situation (like the famous and very often used Sioux City Accident).
- It should be possible to register incidents anonymously in all countries. However, anonymous registrations of incidents may not in itself be a sufficient solution if the trainee does not believe in/trust the “good intentions” of the management; i.e. focusing on team performance rather than individual “culpa”.
- Incidents are reported in Sweden according to a standard procedure, but the informants said that the Swedish database of incidents and accidents from outside Sweden is too old.
- The case database should include cases from all over the world (and possibly also hypothetical cases). A database with cases would be welcomed because there are no media today where cases can be rapidly renewed, presented, easily accessed and discussed besides “stand alone” introduction

CRM courses. There is disagreement about to what extent discussions of known colleagues should be avoided. One pilot said that “... I have never come across the attitude that one should avoid discussing colleagues”.

- There is disagreement about how realistic the physical simulation must be. One informant strongly recommended full scale simulations of real incidents and accidents in order to learn from personal errors in crew communication rather than the errors of other crews.
- Flight simulators and ATC simulators should be linked in order to establish realistic joint training. A suggestion was to remove the PFT instructor and replace him/her with real ATC personnel.
- It was suggested that practical training of e.g. “communication skills” can be learned through the use of various tasks that are not related to the domain, but any task that requires co-operation and correct communication.
- Post qualification training is an advantage (in training effect) compared to introduction courses, because experienced operators can relate human factors to real life situations.
- CRM distance learning should be based on interest and introduced as an offer, i.e. with no elements of “return offers” from trainees.
- CRM training through computer networks should be regarded as a supplement to existing full scale simulator training. CRM should be checked during practical team work in a simulator.
- Human factors terminology should be limited, especially in recurrent training (trainees should not become psychologists, although a framework is needed). One should focus on domain specific problems. Ideally one should merge human factors know how and domain specific know how.
- Videos are reported as useful in training, especially videos of cases. It is also suggested that videos sometimes are a better way of presenting material than through computers. The BBC television series “Black Box”, a series about human factors in aviation, is specifically mentioned as a very good example: the presentation form is a mixture between “entertainment” and “education” in that a story-teller form is used, when at the same time important issues are treated seriously. Also, video conferences are suggested due to the possibility of interaction, although this possibility is still limited.
- Informants generally emphasise that motivation comes from either 1) the need for preparing before an “exam”, or 2) a personal interest: the personal interest is dependent on relevant information being presented in an exiting, interesting and documentary style.
- A HF course provides a theoretical HF knowledge and therefore it can be held in an instructional way. A CRM course is aimed at discussing how HF concepts can be applied in the pilot’s job and it has to be done in a group where people can share their own experiences.

End User Support

- One can not assume that all trainees know how to use a PC and a keyboard

or that they have access to such equipment. This is probably true despite the fact that all trainees in aviation participate in Computer Based Training (CBT). Neither can one assume that all trainees are willing to learn how to use such equipment (older trainees). One informant (instructor) estimated that approximately 10 percent of the trainees in the airline would refuse any type of distance learning through the use of computers, and that at least 30 percent of the trainees would need an introductory course to the use of PC's. Another informant thought that all trainees would benefit from PC introduction courses.

- None of the informants had any experience in network communication. Thus, both technical introductory training and continuous support is probably necessary. An introductory course to the use of PC and PC based learning materials, web services, news/mail groups etc. is suggested. The interface should be continuously renewed to meet the needs of both beginners and more experienced users. See also Sanderson (1997) chapter 3.3.4.
- Simultaneous discussions are probably not essential, according to one of the instructor informants; "one can live with a delayed reply". Another informant emphasised the importance of immediate "face to face" feedback, and used this as an argument against computer communication. It is also claimed that communication may be difficult through e-mail, i.e. that face to face communication is needed. On the other hand, verbal (remote) communication through various types of equipment is not irrelevant to the real work situation of an operator. See also Sanderson (1997) chapter 3.3.
- Further more, it is emphasised that a (computer based) distance learning system must offer some kind of support on the human factors contents. There should be someone (instructors) available that can answer questions.
- All kind of support allowing group dynamics and interaction must be envisaged.

## 4 The Learning Environment

### 4.1 The Training Location

It was suspected that maritime crews should be able to do CRM training while at sea, during spare time. However, informants from the DMI denied that this is possible (data set 1). While at sea, no one has the time to do training, due to very tight schedules. During spare time, the crew members will prefer to sleep or relax in other ways. Crew members may instead participate in CRM training through a PC with a modem when they are at home, i.e. when they are not sailing. On the other hand, at MarConsult it is claimed that (data set 3): "the long period of inactivity offshore is very often a major problem for seamen. Attending a distance training course is a great opportunity to improve their knowledge and an excellent remedy to boredom."

Pilots may study at home using a PC, but there is doubt about to what extent such an opportunity will be used in the spare time (this has been a major point

of discussion between SAS and the pilot union). The family life will come first, even if the individual crew member is highly motivated to participate in CRM training and regardless of how interesting and relevant the presentation is. There can be problems caused by unions that will not accept pilots working at home, or within a non-scheduled planning.

It was suggested that “crew relaxation” during long flights could be used to study CRM material. Some competition must be expected from “private” conversations, but during so called “slings” (SAS try to keep crews together during a period of time, e.g. five days), CRM material may be studied.

It is not very likely that CRM material (e.g. cases) placed in the “home base library” will be used in their present form. A suggestion that came up was to put “small advertisements and written material” in the pilot’s post box, referring to “more information” on e.g. a web page that they may access from their home computer.

Air Traffic Controllers (ATC) claim that CRM/TRM distance learning can take place during breaks when at work. However, ATC personnel from Sweden think that a body of working hours should be reserved for TRM training. It is claimed that there is no remaining time to use for this type of additional training in the Swedish system. A general problem for ATC is that crews are on duty in shifts that run asynchronously and that many ATC crews are seated in provincial parts of the country. Accessing a database with CRM learning material is possible in-between shifts, possibly in the control tower or in a classroom in the same building. It should also be possible to do some studying at home, especially since ATC personnel often live a long way from the airport (there are not that many airports). It is emphasised that there is no such offer today and that people who want to learn more are experiencing limited resources. As a consequence of these problems, small groups within ATC participating in CRM training may experience a group pressure when returning to their normal work: one may conform to the “usual way of doing things” because the majority of operators do not know about/understand the trainee’s attempts to apply a better team work behaviour.

Anaesthesia personnel may train at work during inactive periods of the shift, and possibly at home through a computer network.

## 4.2 Problems Related to Culture

- Problems of language and culture are closely linked. First, informants have experienced difficulties related to differences between the Danish, Swedish, Norwegian and English languages during training. Trainees want to receive training in their native language, i.e. together with trainees with equal native language.
- Secondly, there are operational problems related to differences in native language: in theory this should not be a problem since English is the formal working language. Informants still think this should be a major issue in CRM training, since it is easy to be confused. Some informants also claim that there are different “moods” associated with different nationalities. Other informants disagree on this issue.
- All informants commented on problems related to differences in manage-

ment style. It seems that instructors and captains believe that “dominant” captains and “easily dominated” second officers and other personnel are approaching each other in style, e.g. that today the 1<sup>st</sup> officer is less afraid of correcting the captain than ten years ago (see “power distance”, Hofstede, 1984). However, some junior officers and other crew members still experience this problem and want it to remain as an important CRM issue: it is very much the captain who defines the “default crew mood”. It is also suggested that dominant captains do not know that they are dominant. There is disagreement between informants on this issue. Most informants from ATC mention the problem of “macho attitudes” both in relation to training and operative work.

- Another operational problem is communication out of the cockpit, i.e. between pilots and ATC. The informants claim that ATC is not trusted in all parts of the world and that it is important to be aware of this, i.e. whom to trust and to what extent. This is claimed to be a problem even within Scandinavia: e.g. Norwegian ATC are “known” to be too optimistic about landing conditions, apparently to “help” the pilots landing in accordance with their own company procedures. This is an example of a potentially dangerous misconception of “help” that pilots and ATC should find valuable to discuss. There is disagreement between pilots and ATC on the importance of this problem, but all informants from aviation in DK recognise the problem.
- One informant claimed that there are crews within aviation today who, by Scandinavian standards, perform less well on CRM issues and even on technical related skills. (An East European airline was mentioned). A major problem seems to be the conformity to authority and the “macho” behaviour of authorities within certain cultures. CRM training should focus on such culturally defined attitudes in order to change them. In addition comes the problem of language (i.e. poor command of English).

## 5 Evaluation of CRM training

- All trainee informants agree that individual CRM exams should be avoided. Instructors are also sceptical about individual exams, but one instructor thought that the subjective evaluation of CRM performance could be improved by using a quantitative measure, i.e. assigning a number to observed performance for both crews and individuals. Objective evaluation is more difficult. Another instructor mentioned the positive effect exams may have on motivation (threats), although “positive” motivation (rewards) resulting from interesting courseware may be the ideal goal.
- Generally it seems that “feedback” is preferred to more “hard” evaluation. Also, CRM is included in PFT. Thus PFT (LOFT simulations) functions as a check of CRM. It is possible, and it has happened occasionally, that a crew member or the whole crew is grounded due to a lack of acceptable CRM performance. One informant said that this check is the best feature of the CRM initiative today, and that the selection criteria are perhaps more important to ensure acceptable CRM. The argument was that one can not change a personality. (However, it is considered possible to change attitudes

and behaviours.)

- Evaluations of CRM course effects have never been a priority. “Everyone” (all stakeholders) agree on the need for CRM training. Awareness of CRM is viewed as sufficient to avoid possible future accidents. There may be an unwillingness towards any type of individual evaluation beyond “feed-back”. However, a general interest in more empirical evaluations of CRM course effects is expressed.
- One informant mentioned that questionnaires are less interesting as measures of CRM. Empirical evaluations should focus more on the actual performance, because there may be a gap between e.g. attitudes and actual behaviour/performance.

## 6 Summary and Conclusions

### 6.1 Informants Agree

- Informants emphasise the need for studying realistic cases, preferably based on real incidents and accidents. Discussion groups, video films and simulations are suggested. ATC and pilots should train and discuss the same cases together.
- Cases should be easily accessible in a data base and continuously renewed. There is no such source available today.
- Main CRM course issues specifically mentioned are: problems related to language, management styles (problems related to culture) and an increased focus on personality-characteristics in order to know your personal limits.
- HF issues must be directly relevant to the work of the trainee.
- Training should not be mandatory. Offers of e.g. a free computer should not have conditions attached to it. Rather the CRM use of the computer should be marketed as an interesting offer.
- There should not be individual CRM exams and generally less focus on individual blame or “culpa”. However, one could evaluate course effects empirically.

### 6.2 Informants Disagree

- Regulators (European Civil Aviation Authority and French CAA) strongly disagree with the idea of a “distance” CRM course. Distance training should be used only to provide HF theoretical knowledge, i.e. as an introductory course. Consequently, these regulators (and some trainees) disagree with the use of computers for CRM training. It is argued that CRM based on distance computer training is contradictory to the idea of CRM, mainly be-

cause of the lack of group dynamics and interaction.

- Pilots seem to have less possibilities for self studying during spare time and breaks at work than ATC, maritime and medical personnel (see paragraph 4.1). Crew relaxation may be the only time when pilots are able to read CRM material. (However, a link between crew relaxation and a computer network at home could possibly be established through “interesting direct mail” in the home base mail box.)
- CRM training should be differentiated depending on personality and situation variables.

## 6.3 Conclusions and User Requirements

1. The “CRM” term is used in different ways by different stakeholders. Thus, disagreements may be caused by misunderstandings: practical skills must be separated from theoretical knowledge. SafetyNet may at least be used to learn factual knowledge, i.e. human factors theory, and to discuss cases of real incidents and accidents related to human factors issues. This may be achieved through a PC in a network, seated at home during spare time or during breaks at work (see paragraph 4.1).
2. The whole target population of trainees within a domain should be able to require (initial) knowledge of CRM within the same period of time, thus possibly reducing the problem of returning to “old habits” when back on work after a CRM course
3. The theoretical courseware should be clearly discriminated from the discussions of incidents and accidents. A second major discrimination is that of general and domain specific training.
4. The end user should have an opportunity to be anonymous in relation to other users (possibly by using aliases).
5. The user needs different types of communication modes: directly to one person (delayed reply/e-mail), directly to pre defined groups of persons (delayed reply/various e-mail lists), to the whole domain and to several domains (news), and simultaneously to one or several participants in a discussion (chat, multi-media conferences).
6. The case data base must be a part of SafetyNet and continuously renewed. Cases must be edited to fit the educational purpose (e.g. a summary and problems to be discussed) with links to a CRM glossary, CRM theory (general/specific), video/audio and the course syllabus. All cases should be accessible to all domains.
7. Users, e.g. pilots and ATC operators, must be able to discuss cases (incidents and accidents) and procedures both within and between the domains (expanding the “team” concept). Users from different domains should preferably have a possibility for participating in similar discussions within other domains (but possibly discriminated from users within that domain).
8. Trainees will need support: both introductory courses to network communication etc. and support (not necessarily simultaneous) on human factors



contents.

9. Avoid too much text with human factors expressions and abbreviations. The (initial) theoretical training should provide a conceptual framework for discussion of cases. Recurrent training, e.g. discussion of cases, should only have links back to the theory courseware and the CRM glossary. Recurrent CRM training must be directly relevant to the specific domain and the practical work of the trainee.
10. Also, encourage discussions and elaboration of realistic cases by informing about and using interesting videos of cases/animation of cases (e.g. like in the BBC “Black Box” series).

## 7 References

- FAA Federal Aviation Administration (1995): National plan for civil aviation human factors: An initiative for research and application. Washington: U.S. Department of Transportation.
- Hayward, B. (1995): Extending Crew Resource Management: An Overview. In N. McDonald, N. Johnston, and R. Fuller (Eds.), Applications of psychology to the aviation system, Vol. 1, pp. 237-242, Aldershot: Avebury Aviation.
- Helmreich, R.L. (1996): The Evolution of Crew Resource Management. Paper presented at the IATA Human Factors Seminar, Warsaw, Poland, Oct. 31.
- Hofstede, G. (1984): Cultures’ Consequences: International Differences in Work Related Values. Swets and Zeitlinger.
- Pariès, J. and Amalberti, R. (1995): Recent trends in aviation safety: from individual to organisational resources management training. Risø I - series. Risø National Laboratory, Roskilde, Denmark.
- Sanderson, M. (1997): Distance Learning and Best Practice Report. SafetyNet Esprit Project 23917, Deliverable D112, Version 1, Risø National Laboratory, Roskilde, Denmark.
- Wiener, E.L., Kanki, B.G. and Helmreich, R.L. (1993): Cockpit Resource Management. San Diego: Academic Press.

## 8 Abbreviations

AE	Air Europe
AF	Air France
ATC	Air Traffic Control
AZ	Alitalia
Ch	Chapter 3-5 in the D112 “Best Practice” report
CAA	(Danish) Civil Aviation Authorities
CAAA	(Danish) Civil Aviation Authorities Academy, associated partner.
CBT	Computer Based Training

CPH	Copenhagen (Copenhagen Airport; Kastrup)
CRM	Crew Resource Management (or Cockpit Resource Management).
DEDALE	Main partner.
DGAC	(French) Civil Aviation Authority
DMI	Danish Maritime Institute, main partner.
FA	Flight Academy, i.e. SASFA in Stockholm, associated partner.
HF	Human Factors
JAA	(European) Joint Aviation Authority
LOFT	Line Oriented Flight Training
MAERSK	Airline in Denmark, Maersk Air
MarConsult	Maritime consultants
MC	Music Cassette (90)
MD	MiniDisc (74)
p	pilot
PC	Personal Computer
PFC	Proficiency check (same as PFT)
PFT	Periodic Flight Training
PGT	Periodic Ground Training (“emergency training”)
RTO	Rejected Take Off
SAS	Scandinavian Airline Systems
SOPHUS	Anaesthesia simulator in Denmark
T.O.	Take Off
TRM	Team Resource Management
Q	Questions, the key words in the interviews

Title and authors

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Abstract (max. 2000 characters)

This report describes user requirements to an Internet based distance learning system of human factors training, i.e. the SafetyNet prototype, within the aviation (pilots and air traffic control), maritime and medical domains. User requirements to training have been elicited through 19 semi-structured interviews (60 minutes each). The informants (interviewees) were mainly end users, i.e. instructors and trainees. They expressed general agreement on “major course contents” and some doubts concerning “methods of knowledge delivery” and the “learning environment”.

Descriptors INIS/EDB